

COPEPODA ASSOCIATED WITH GORGONACEANS (CNIDARIA) IN THE INDO-PACIFIC

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ABSTRACT

Four new copepods associated with gorgonaceans are described: *Doridicola rumphellae* n. sp., from *Rumphella antipathes* in New Caledonia, and *Paramolgus dapsilis* n. sp., from *Suberogorgia reticulata*, at Bohol in the Philippines and at Ceram (both Poecilostomatoida); *Orecturus finitimus* n. sp., from *Acanthogorgia* sp. at Banda in the Moluccas and *Villogorgia intricata* at Bohol, and *Orecturus forticulus* n. sp., from *Melitodes ochracea* at Banda (both Siphonostomatoida). New records are added for: *Acanthomolgus combinatus* Humes, 1974, from *Echinogorgia* sp. at Banda; *Acanthomolgus astrictus* Humes and Stock, 1973, from *Muricella* sp. and *Villogorgia intricata* at Bohol, from *Acalycigorgia* sp., *Muricella* sp., and *Acanthogorgia* sp. in the Moluccas, and *Rumphella antipathes* in New Caledonia; *Doridicola cinctus* from *Rumphella antipathes* in New Caledonia; *Forhania philippinensis* Humes, 1990, and *Thamnomolgus nodulus* Humes, 1990, both from *Villogorgia intricata* at Bohol; *Orecturus grandisetiger* Humes, 1992, from *Acanthogorgia* sp., at Banda; and *Asteropontius latus* Humes, 1992, from *Villogorgia intricata* at Bohol.

Several poecilostomatoid copepods associated with gorgonaceans in the Indo-Pacific Ocean have been described: *Acanthomolgus arctatipes* Humes, 1974, from *Echinogorgia sasappo* (Esper); *Acanthomolgus astrictus* Humes and Stock, 1973, from *Acanthogorgia aspera* (Pourtales) (Humes and Stock, 1973) and *Muricella rubra robusta* Thompson and Simpson (Humes, 1974); *Acanthomolgus combinatus* Humes, 1974, from *Echinogorgia sasappo*; *Acanthomolgus hales* Humes and Stock, 1973, from *Solenocaulon tortuosum* Gray; *Acanthomolgus mopsellae* Humes, 1974, from *Mopsella rubeola* Wright and Studer; *Doridicola cinctus* (Humes and Stock, 1973), from *Psammogorgia ramosa* Kükenthal; *Forhania philippinensis* Humes, 1990a, from *Acabaria rubeola* (Wright and Studer) and *Suberogorgia reticulata* (Ellis and Solander); *Telestacicola angoti* Humes and Stock, 1973, from *Suberogorgia reticulata*, *Suberogorgia suberosa* (Pallas) (Humes, 1974), and *Muricella rubra robusta* (see Humes and Stock, 1973); and *Thamnomolgus robustus* Humes, 1969, from *Acanthogorgia aspera* (Humes and Stock, 1973).

Members of the family Lamippidae, commonly occurring in Indo-Pacific Gorgonacea, are not included here. Although this family was placed in the Poecilostomatoida by Bowman and Abele (1982), it has more recently been referred to the Siphonostomatoida (Stock, 1988).

This paper contains descriptions of two poecilostomatoids, *Doridicola rumphellae* n. sp., and *Paramolgus dapsilis* n. sp., and two siphonostomatoids, *Orecturus finitimus* n. sp., and *Orecturus forticulus* n. sp. New records are given for *Doridicola cinctus* (Humes and Stock, 1973), *Forhania philippinensis* Humes, 1990a, *Thamnomolgus nodulus* Humes, 1990a, *Acanthomolgus astrictus* Humes and Stock, 1973, *Acanthomolgus combinatus* Humes, 1974, *Orecturus grandisetiger* Humes, 1992c, and *Asteropontius latus* Humes, 1992c.

MATERIALS AND METHODS

At the time the living gorgonaceans were collected, the colonies or fragments thereof were immediately isolated in sea water in plastic bags, thereby preventing loss of associated copepods and avoiding contamination between colonies. In the laboratory the colonies were soaked and thoroughly washed in the same sea water in which they had been collected, to which 95% ethanol had been added to

make approximately a 5% solution. The copepods were then recovered from the sediment obtained after passing the entire water through a fine net (125 holes per 2.5 cm).

All measurements and dissections were made on specimens in lactic acid, following the method used by Humes and Gooding (1964). The length of the body includes the caudal rami but not their setae. The lengths of the segments of the first antennae were measured along their posterior nonsetiferous margins. In the formulae for the armature of legs 1-4 Arabic numerals represent setae, Roman numerals spines. The letter after the explanation of each figure indicates the scale at which it was drawn.

Poecilostomatoida Thorell, 1859
Sabelliphilidae Gurney, 1927

Forhania philippinensis Humes, 1990

Material Studied.—4 ♀, 3 ♂ from *Villogorgia intricata* (Gray), in 30 m, Bohol Island, Philippines, 10°17.9'N, 124°10.9'E, 21 August 1975, Thomas Forhan collector.

Remarks.—Thus far *Forhania philippinensis* has been found only on the gorgonaceans *Acabaria rubeola* and *Suberogorgia reticulata* at Bohol (Humes, 1990a).

Thamnomolgus nodulus Humes, 1990

Material Studied.—1 ♀ from *Villogorgia intricata*, in 30 m, Bohol Island, Philippines, 10°17.9'N, 124°10.9'E, 21 August 1975, Thomas Forhan collector.

Remarks.—This sabelliphilid has so far been known only from the antipatharian *Antipathes* sp. at Bohol (Humes, 1990a).

Lichomolgidae Kossmann, 1877

Acanthomolgus Humes and Stock, 1972
Acanthomolgus astrictus Humes and Stock, 1973

Material Studied.—141 ♀, 49 ♂, and 36 copepodids, from *Muricella* sp., in 40 m, Bohol Island, Philippines, 10°17.9'N, 124°10.9'E, 22 September 1975, Thomas Forhan collector; 10 ♀, 19 ♂ from *Muricella* sp., in 10 m, Poelau Parang, Ceram, Moluccas, 03°17'00"S, 130°44'48"E, 23 May 1975; 52 ♀, 48 ♂ from *Muricella* sp., in 10 m, Poelau Parang, 23 May 1975; 7 ♀, 1 ♂ from *Acalycigorgia* sp., in 10 m, Poelau Gomumu, Moluccas, 01°50'00"S, 127°30'54"E, 30 May 1975; 16 ♀, 5 ♂ from *Acanthogorgia* sp., in 25 m, southern shore of Goenoeng Api, Banda Islands, Moluccas, 04°32'05"S, 128°52'30"E, 26 April 1975; 6 ♀ from *Rumphella antipathes* (Linnaeus), in 2 m, Ricaudy Reef, near Noumea, New Caledonia, 22°19'00"S, 166°26'44"E, 15 July 1971; 14 ♀ from *Villogorgia intricata*, in 30 m, Bohol Island, Philippines, 10°17.9'N, 124°10.9'E, 21 August 1975.

Remarks.—The range of this species is extended from Madagascar, where it occurs on the gorgonaceans *Acanthogorgia aspera* (see Humes and Stock, 1973) and *Muricella rubra robusta* (see Humes, 1974), to the Philippines. New host records are: *Acalycigorgia* sp., *Acanthogorgia* sp., *Muricella* sp., *Rumphella antipathes*, and *Villogorgia intricata*.

Acanthomolgus combinatus Humes, 1974

Material Studied.—14 ♀, 234 ♂ from *Echinogorgia* sp., in 10 m, Goenoeng Api, Banda Islands, Moluccas, 04°31'45"S, 129°51'55"E, 25 May 1975.

Remarks.—The range of this species is extended from Madagascar, where it is known to be associated with the gorgonian *Acanthogorgia sasappo* (Humes, 1974), to Banda in the Moluccas. *Echinogorgia* sp. is a new host record for this copepod.

Doridicola Leydig, 1853
Doridicola cinctus (Humes and Stock, 1973)

(=*Metaxymolgus cinctus* Humes and Stock, 1973: 232.)

Material Studied (all from *Rumphella antipathes*).—10 ♀, 29 ♂, in 1 m, west of Ile Mando, near Noumea, New Caledonia, 22°18'59"S, 166°09'30"E, 15 July 1971; 44 ♀, 18 ♂, in 2 m, Ricaudy Reef, near Noumea, New Caledonia, 22°19'00"S, 166°26'44"E, 20 July 1971.

Remarks.—This species is known from *Psammogorgia ramosa* in Madagascar (Humes and Stock, 1973; Humes, 1974). Detailed measurements of the copepods from *Rumphella antipathes* (length of female, 1.22 mm (1.14–1.30 mm), that of male, 0.92 mm (0.87–0.95 mm) vary slightly from those given by Humes and Stock (1973) for *Doridicola cinctus* (female 1.12 mm (1.06–1.19 mm), male 0.93 mm (0.86–0.96 mm)). However, there is sufficient overlap between the Madagascar and New Caledonia specimens to warrant consideration as one species. The size and form of the free segment of leg 5 in the female is somewhat variable, both in paratypes, recently reexamined, and in specimens from *Rumphella antipathes* in New Caledonia. In spite of this variability, the specimens from Madagascar and New Caledonia are judged to be conspecific.

Doridicola rumphellae new species
Figures 1a–e, 2a–j

Type Material.—5 ♀ from *Rumphella antipathes*, in 1 m, west of Ile Mando, near Noumea, New Caledonia, 22°18'59"S, 166°09'30"E, 15 July 1971. Holotype ♀ (256977) and 4 female paratypes (256978) deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Other Specimens.—2 ♀ from *Rumphella antipathes*, in 2 m, Ricaudy Reef, near Noumea, New Caledonia, 22°19'00"S, 166°26'44"E, 22 July 1971.

Female.—Body (Fig. 1a) with moderately broad prosome. Length 1.36 mm (1.33–1.41 mm) and greatest width 0.57 mm (0.48–0.62 mm), based on 5 specimens. Greatest dorsoventral thickness 0.44 mm. Somite bearing leg 1 separated from cephalosome by dorsal transverse furrow. Epimera of metasomal somites rounded. Ratio of length to width of prosome 1.54:1. Ratio of length of prosome to that of urosome 1.96:1.

Somite bearing leg 5 (Fig. 1b) $73 \times 185 \mu\text{m}$. Genital double-somite (Fig. 3) subquadrate, 156 μm long, 146 μm wide at level of genital areas, 140 μm wide at level of small lateral lobes, and 104 μm wide posteriorly. Transverse median dorsal sclerotization near level of lateral lobes. Genital areas (Fig. 1c) situated in anterior half of somite, both areas with 2 small setae approximately 12 μm . Three postgenital somites from anterior to posterior 60×91 , 49×83 , and $42 \times 78 \mu\text{m}$.

Caudal ramus (Fig. 1d) subquadrate, $39 \times 35 \mu\text{m}$, unornamented, ratio 1.11:1. Outer lateral seta 86 μm , dorsal seta 46 μm , outermost terminal seta 125 μm , innermost terminal seta 190 μm , and 2 long median terminal setae 330 μm (outer) and 495 μm (inner). All setae with lateral setules.

Egg sac unknown.

Rostrum rounded posteroventrally. First antenna (Fig. 1e) 7-segmented, with formula 4, 13, 6, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. Lengths of segments: 55 (81 μm along posterior margin), 125, 35, 70, 62, 52, and 44 μm , respectively. All setae smooth. Second antenna (Fig. 2a) 4-segmented, formula 1, 1, 3, and 2 unequal claws plus 4 setae. Fourth segment 73 μm along outer side,

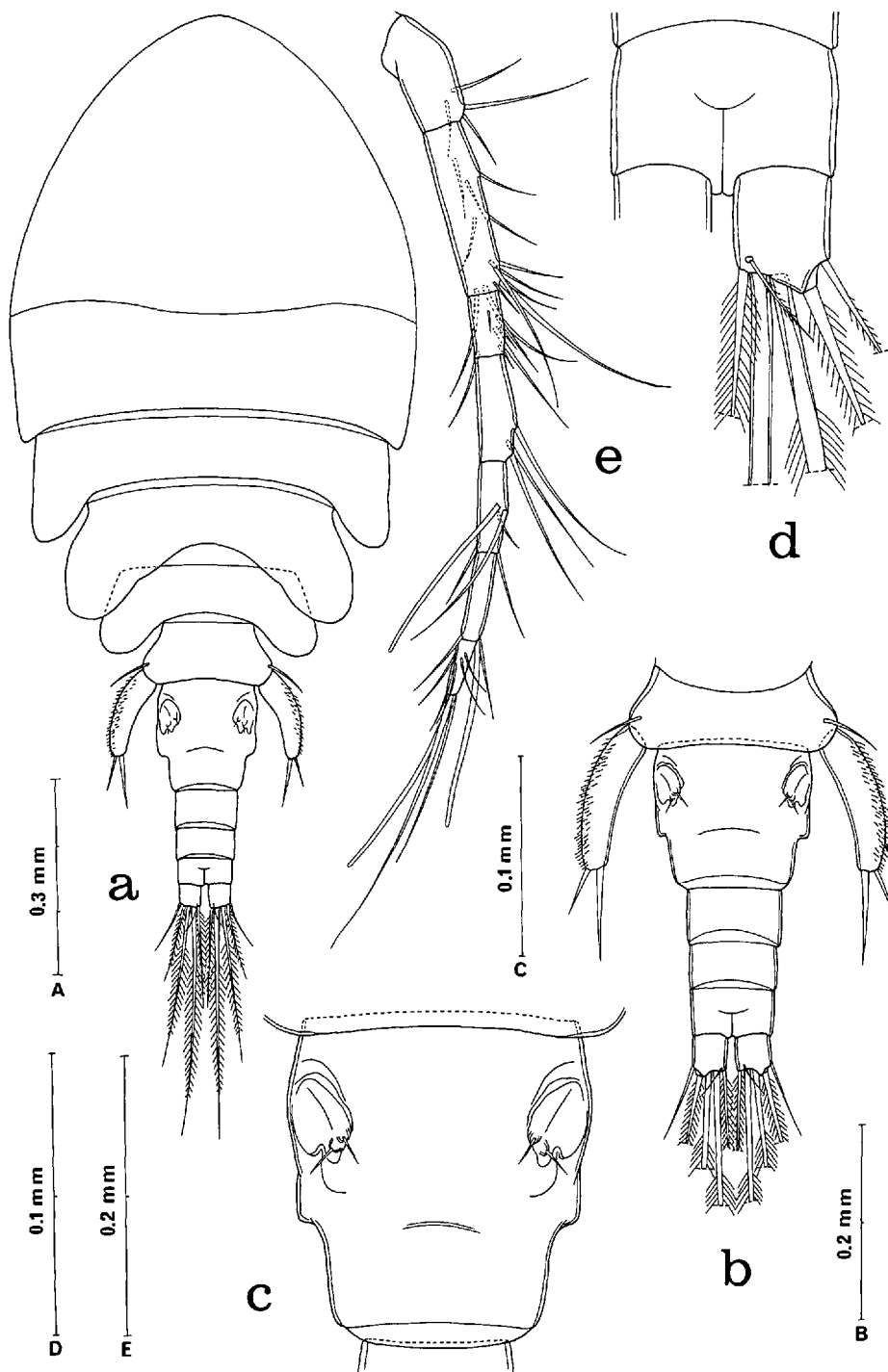


Figure 1. *Doridicola rumphellae* n. sp., female. a, dorsal (scale A); b, urosome, dorsal (B); c, genital somite, dorsal (C); d, anal somite and caudal ramus, dorsal (D); e, first antenna, posterodorsal (E).

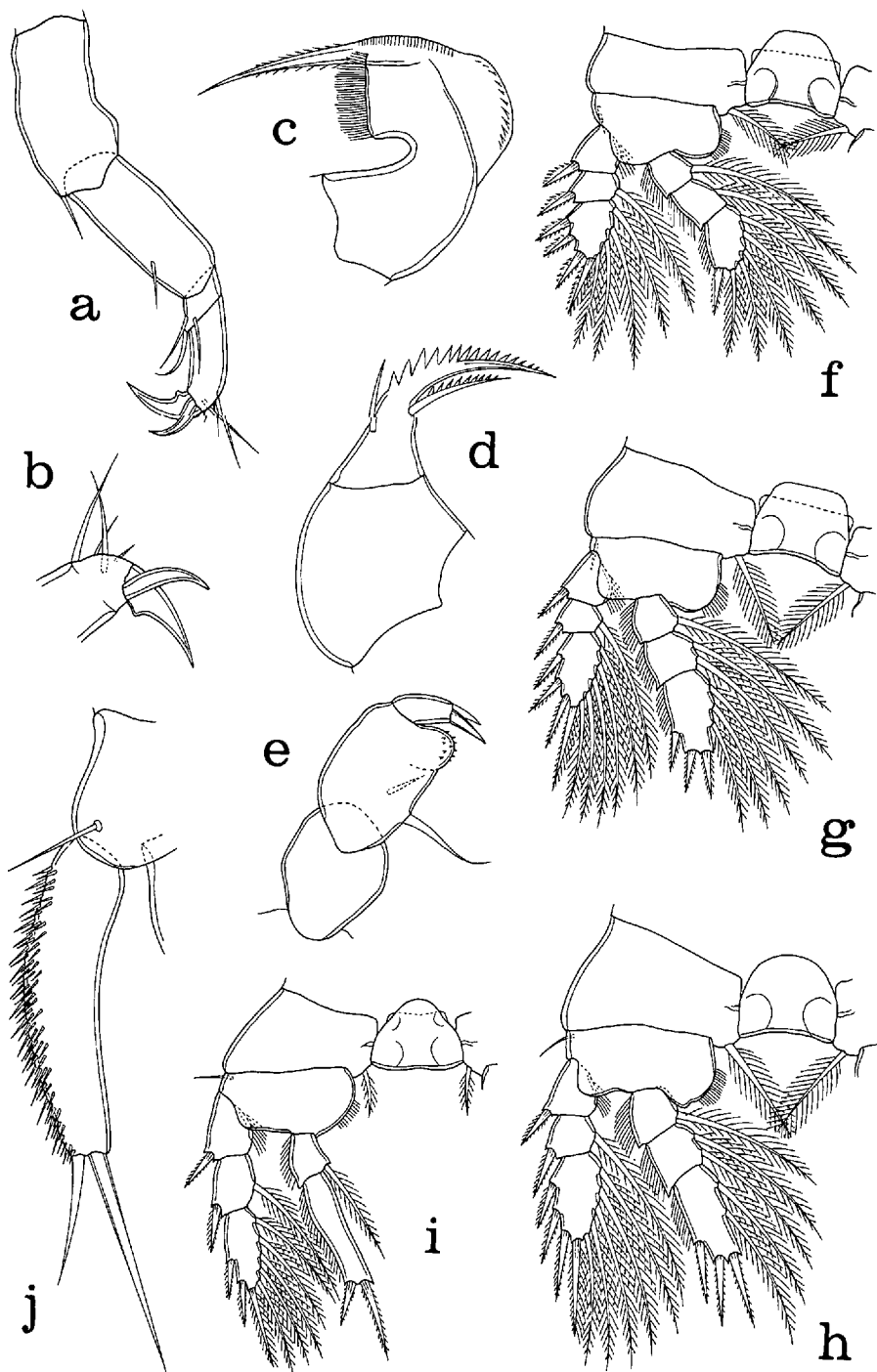


Figure 2. *Doridicola rumphellae* n. sp., female. a, second antenna (scale E); b, distal end of second antenna, posterior (D); c, mandible, anterior (D); d, second maxilla, posterior (C); e, maxilliped, posterior (C); f, leg 1 and intercoxal plate, anterior (B); g, leg 2 and intercoxal plate, anterior (B); h, leg 3 and intercoxal plate, anterior (B); i, leg 4 and intercoxal plate, anterior (B); j, leg 5, dorsal (C).

38 μm along inner side, and 25 μm wide. Slender claw 33 μm , stout claw 40 μm , with minute proximal inner knob (Fig. 2b).

Labrum with 2 broad posteroventral lobes. Mandible (Fig. 2c), first maxilla, second maxilla (Fig. 2d), and maxilliped (Fig. 2e) resembling in general form those of *Doridicola cinctus*.

Legs 1–4 (Fig. 2f–i) similar to those of *D. cinctus*, with same spine and setal formula. Leg 4 (Fig. 2i) with inner coxal seta 36 μm . Exopod 198 μm . First segment of endopod $53 \times 40 \mu\text{m}$ (59 μm long including small terminal spiniform process), its inner distal plumose seta 94 μm . Second segment 120 μm long including spiniform process, greatest width 34 μm , least width 24 μm , its 2 terminal barbed spines 40 μm (outer) and 78 μm (inner). Both segments with outer marginal setules.

Leg 5 (Fig. 2j) with elongate free segment $146 \times 36 \mu\text{m}$, ornamented along outer surface with many relatively long, slender spinules. Two terminal setae 52 μm and 96 μm , dorsal seta on somite 45 μm . All setae smooth.

Leg 6 represented by 2 small setae on genital area (Fig. 1c).

Color of living specimens opaque gray, eye red.

Male. — Unknown.

Etymology. — The specific name is formed from the generic name of the host gorgonacean.

Remarks. — Among the more than 40 species currently recognized in the genus *Doridicola*, none shows, as in the female of the new species, the combination of a subquadrate genital somite with small lateral lobes, leg 5 with an elongate free segment without an inner proximal expansion and ornamented with long slender spinules, and a subquadrate caudal ramus. The minute proximal inner knob on the larger of the two claws of the second antenna seems also to be distinctive.

Paramolgus Humes and Stock, 1972

Paramolgus dapsilis new species

Figures 3a–i, 4a–i, 5a–g

Type Material. — 1,118 ♀, 2,070 ♂, and 1,604 copepodids from *Suberogorgia reticulata*, in 30 m, Bohol Island, Philippines, 10°17.9'N, 124°10.9'E, 22 September 1975, Thomas Forhan collector. Holotype ♀ (USNM 257123), allotype (USNM 257124), and 3,012 paratypes (1,046 ♀, 1,966 ♂) (USNM 257125) deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Remaining paratypes, including copepodids, in the collection of the author.

Other Specimens. — 69 ♀, 68 ♂, and 58 copepodids from 1 colony of *Suberogorgia reticulata*, in 10 m, Poelau Parang, eastern Ceram, Moluccas, 03°17'00"S, 130°44'48"E, 23 May 1975.

Female. — Body (Fig. 3a) moderately slender. Length 0.70 mm (0.65–0.76 mm) and greatest width 0.29 mm (0.29–0.31 mm), based on 10 specimens. Greatest dorsoventral thickness 0.18 mm. Somite bearing leg 1 not separated dorsally from cephalosome. Epimera of metasomal somites rounded. Ratio of length to width of prosome 1.76:1. Ratio of length of prosome to that of urosome 1.82:1.

Somite bearing leg 5 (Fig. 3b) $39 \times 78 \mu\text{m}$. Genital double-somite $81 \times 78 \mu\text{m}$, in dorsal view roundly expanded in midregion, slightly indented laterally at approximately posterior third. Gonopores situated dorsolaterally at expanded portion of segment, both gonopores bearing 2 minute setae. Three postgenital somites from anterior to posterior 29×43 , 26×42 , and $30 \times 42 \mu\text{m}$.

Caudal ramus (Fig. 3c) moderately elongate, unornamented, $40 \times 19 \mu\text{m}$, ratio 2.11:1. Outer lateral seta 33 μm , dorsal seta 11 μm , both smooth. Outermost terminal seta 50 μm , innermost terminal seta 63 μm , 2 median terminal setae 100 μm (outer) and 165 μm (inner), all with lateral setules.

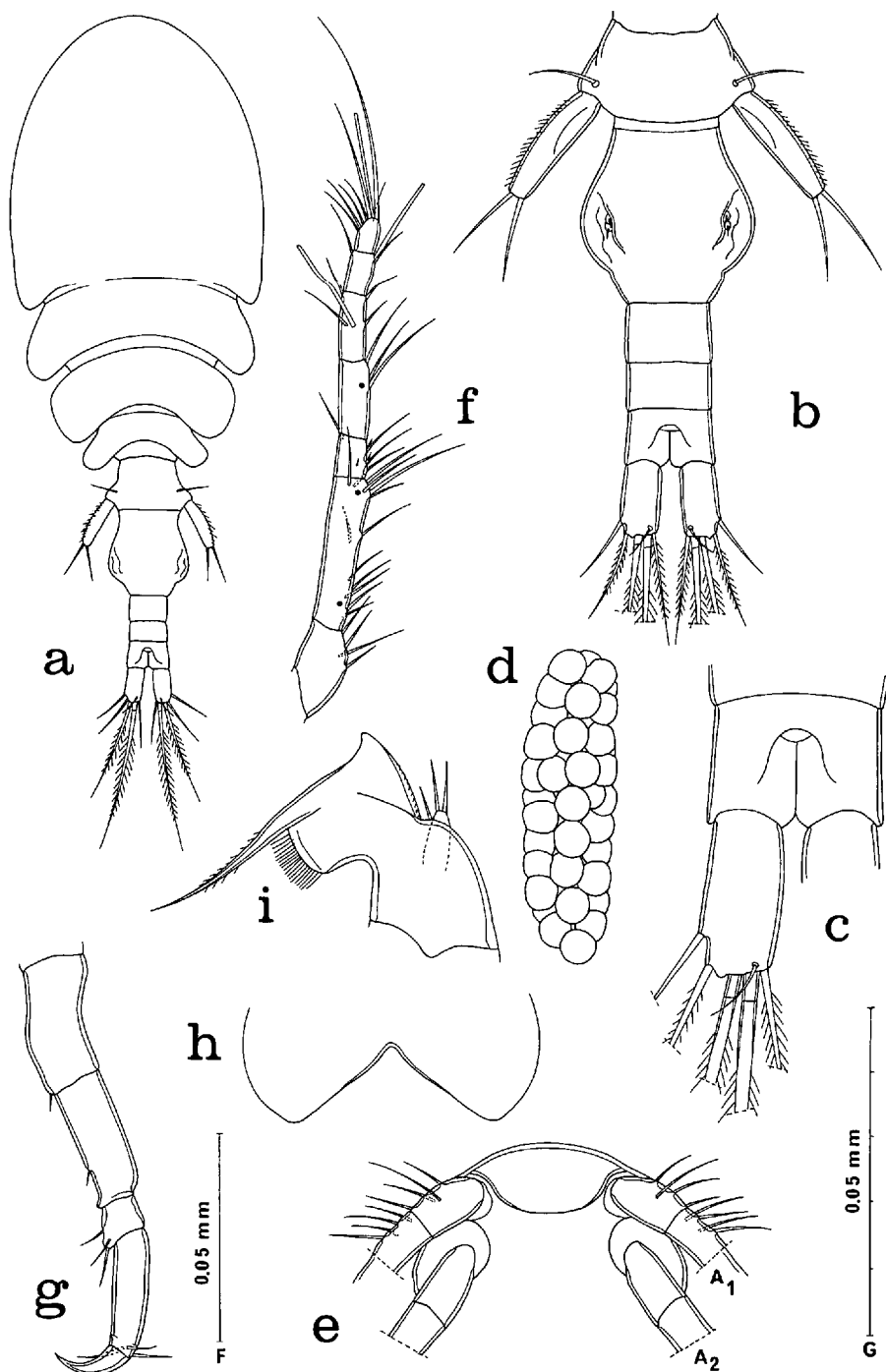


Figure 3. *Paramolgus dapsilis* n. sp., female. a, dorsal (scale B); b, urosome, dorsal (C); c, anal somite and caudal ramus, dorsal (F); d, egg sac, ventral (B); e, rostrum, ventral (C); f, first antenna, with three dots indicating positions of aesthetes added in male, ventral (C); g, second antenna, posterior (C); h, labrum, ventral (F); i, mandible and first maxilla, anterior (G). (A₁ = first antenna, A₂ = second antenna.)

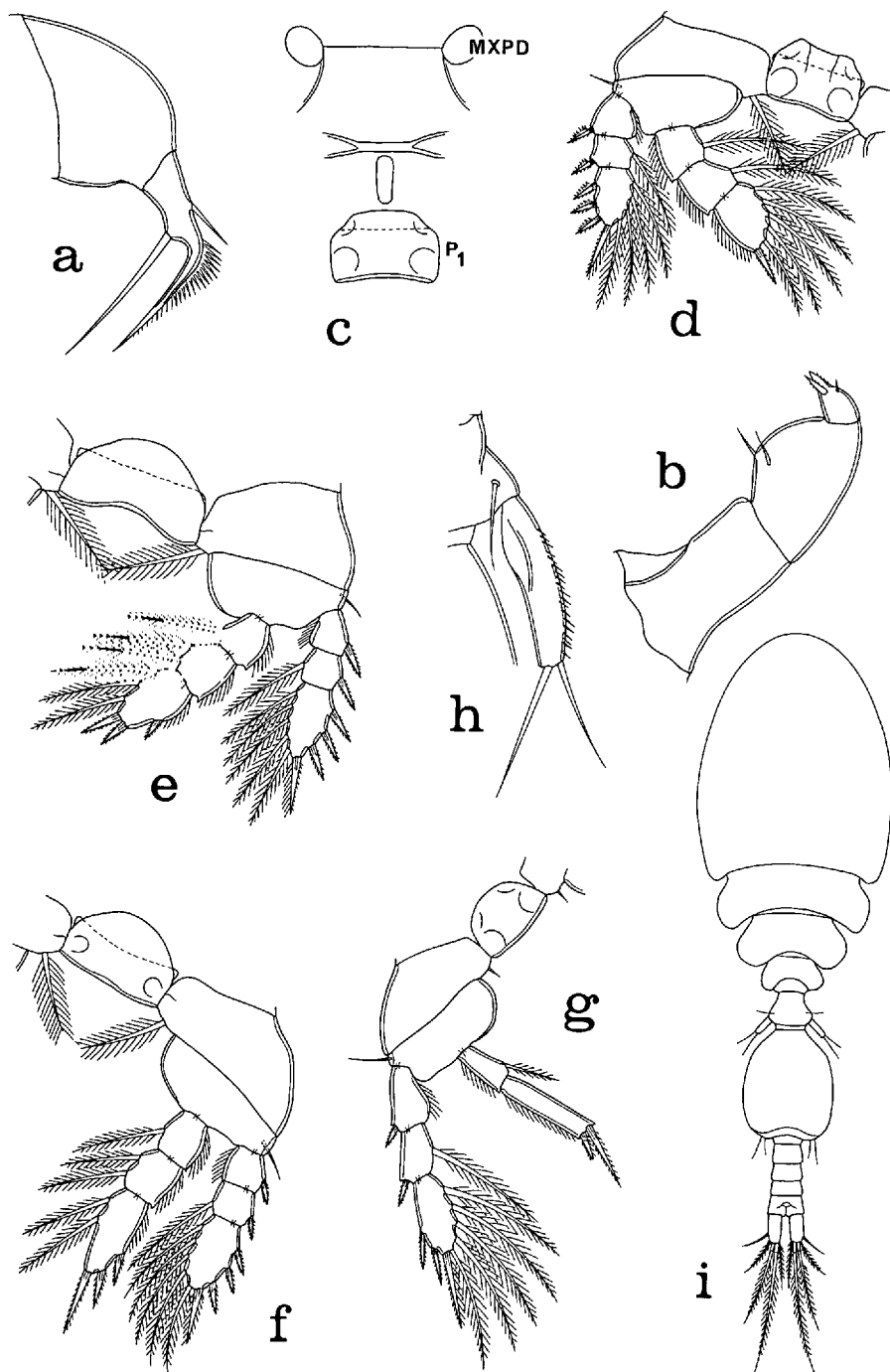


Figure 4. *Paramolgus dapsilis* n. sp. Female. a, second maxilla, antero-outer (scale F); b, maxilliped, posterior (F); c, area between maxillipeds and first pair of legs, ventral (C); d, leg 1 and intercoxal plate, anterior (C); e, leg 2 and intercoxal plate, anterior (C); f, leg 3 and intercoxal plate, anterior (C); g, leg 4 and intercoxal plate, anterior (C); h, leg 5, dorsal (D). Male. i, dorsal (B). (MXPDP = maxilliped, P₁ = leg 1).

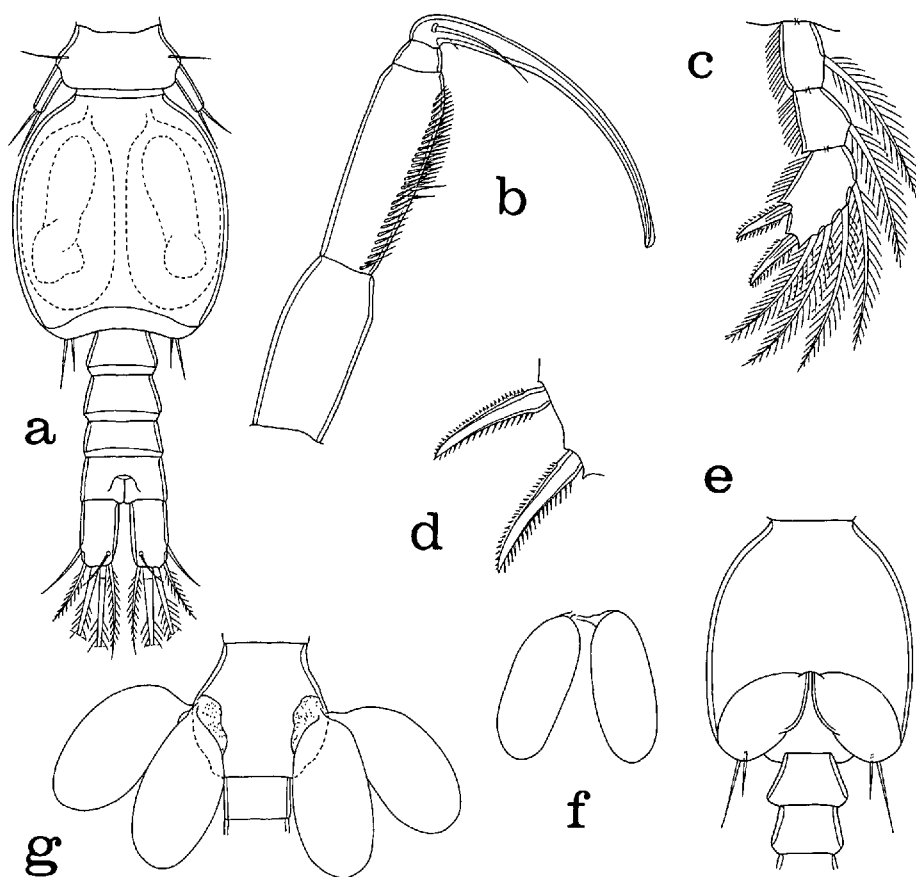


Figure 5. *Paramolgus dapsilis* n. sp., male. a, urosome, dorsal (scale C); b, maxilliped, inner (D); c, endopod of leg 1, anterior (D); d, two spines on endopod of leg 1, anterior (D); e, genital and first two postgenital somites, ventral (E); f, spermatophores attached to female, dorsal (E); g, two pairs of spermatophores attached to genital double-somite of female, dorsal (E).

Egg sac (Fig. 3d) elongate, $320\text{--}340 \times 100 \mu\text{m}$, containing many eggs, each egg $36\text{--}42 \mu\text{m}$.

Rostrum (Fig. 3e) broadly rounded posteroventrally. First antenna (Fig. 3f) 7-segmented, $244 \mu\text{m}$ long. Length of segments: 26 ($42 \mu\text{m}$ along anterior margin), 70, 18, 36, 34, 23, and $18 \mu\text{m}$, respectively. Armature: 4, 13, 6, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. All setae smooth. Second antenna (Fig. 3g) 4-segmented, $195 \mu\text{m}$ long. Armature: 1, 1, 3, and 1 claw plus several setules. Fourth segment slender, $60 \mu\text{m}$ along outer margin, $47 \mu\text{m}$ along inner margin, and $17 \mu\text{m}$ wide. Claw $32 \mu\text{m}$.

Labrum (Fig. 3h) with 2 broad posteroventral lobes. Mandible (Fig. 3i), first maxilla (Fig. 3i), second maxilla (Fig. 4a), maxilliped (Fig. 4b), and ventral area between maxillipeds and first pair of legs (Fig. 4c) generally similar to those in congeners. Inner seta on second segment of second maxilla longer than lash.

Legs 1–4 (Fig. 4d–g) with rami segmented and armed as in congeners. Leg 4 (Fig. 4g) with inner seta on coxa very short, $8 \mu\text{m}$. Exopod $88 \mu\text{m}$. First segment of endopod $24 \times 14 \mu\text{m}$, its inner distal seta $19 \mu\text{m}$. Second segment $45 \mu\text{m}$ long

without spiniform processes, 50 μm with processes, 2 terminal finely barbed spines 13 μm (outer) and 33 μm (inner).

Leg 5 (Fig. 4h) with elongate free segment $62 \times 13 \mu\text{m}$, ratio 4.97:1, its 2 terminal setae 52 μm (inner) and 39 μm (outer). Segment showing slight longitudinal ridge in proximal half and ornamented with spinules on outer surface.

Leg 6 represented by 2 minute setae on both gonopore areas (Fig. 3b).

Color of living specimens from Poelau Parang translucent to slightly opaque gray, eye red. Specimens from Bohol Island preserved in 70% ethanol mostly light brown, but this color perhaps acquired from gorgonian host.

Male.—Body (Fig. 4i) more slender than in female. Length 0.61 mm (0.57–0.64 mm) and greatest width 0.19 mm (0.18–0.21 mm), based on 10 specimens. Greatest dorsoventral thickness 0.16 mm. Ratio of length to width of prosome 1.81:1. Ratio of length of prosome to that of urosome 1.44:1.

Somite bearing leg 5 (Fig. 5a) $23 \times 49 \mu\text{m}$. Genital somite $107 \times 99 \mu\text{m}$. Four postgenital somites from anterior to posterior 21×39 , 19×40 , 17×36 , and $21 \times 36 \mu\text{m}$.

Caudal ramus resembling that of female but smaller, $29 \times 18 \mu\text{m}$, ratio 1.71:1 (Fig. 5a).

Rostrum like that of female. First antenna resembling that of female, but 3 aesthetes added (at locations indicated by dots on Fig. 3f). Second antenna, labrum, mandible, first maxilla, and second maxilla like those of female. Maxilliped (Fig. 5b) slender, 4-segmented (assuming proximal part of claw to represent fourth segment). First segment unarmed, second segment with 2 inner setae and 2 rows of slender spinules. Small third segment unarmed. Claw 122 μm long.

Ventral area between maxillipeds and first pair of legs as in female.

Legs 1–4 as in female except for sexual dimorphism in third segment of endopod of leg 1, with formula I,I,4 (Fig. 5c), 2 barbed spines (Fig. 5d) approximately 22 μm long.

Leg 5 with free segment $18 \times 5 \mu\text{m}$, unornamented (Fig. 5a).

Leg 6 usual posteroventral flap on genital segment, bearing 2 setae 27 μm and 16 μm long.

Spermatophore (Fig. 5f) elongate oval, $104 \times 44 \mu\text{m}$, in most cases attached to female in pair on one side only, but in 3 females pairs of spermatophores on both sides of genital segment as in Fig. 5g.

Etymology.—The specific name *dapsilis*, Greek meaning abundant or plentiful, alludes to the large numbers of individuals found on the gorgonacean host.

Remarks.—*Paramolgus dapsilis* may be distinguished from 17 of the 31 species in the genus by the length of the body in the female. Those species in which the body length exceeds 1 mm, and thus differing from the new species, are: *P. abruptus* Humes, 1990b, *P. alcyoniicus* Humes, 1990b, *P. antillianus* Stock, 1975, *P. centor* Humes, 1990b, *P. clavatus* (Humes and Ho, 1968b), *P. constrictus* (Humes, 1969), *P. extendens* Humes and Dojiri, 1979b, *P. insectus* (Humes, 1969), *P. inconstans* Humes and Dojiri, 1979c, *P. modicus* Humes, 1990b, *P. politus* (Humes and Ho, 1967), *P. pollicaris* Humes and Dojiri, 1979b, *P. quadrangulus* Humes, 1990b, *P. setellus* Humes, 1992a, *P. simulans* (Humes and Ho, 1967), *P. subincisus* Humes, 1990b, and *P. timendus* Humes, 1990b.

The new species may be distinguished from 11 other species which have a body length of less than 1 mm by the ratio of the length to width of the caudal ramus in the female. In four of these species the ratio is distinctly less than in the new species: *P. congruus* Humes, 1990b, *P. eniwetokensis* Humes, 1973, *P. ostentus*

Humes, 1973, and *P. spathophorus* (Humes and Ho, 1968a). In seven other species the ratio is more than 3:1: *P. ampullaceus* Humes, 1992b, *P. angustus* Humes, 1992a, *P. eparmatoides* Humes, 1992a, *P. gibberulus* Humes, 1992a, *P. nephtheanus* Humes, 1980, *P. prominulus* Humes, 1980, and *P. resectus* Humes and Dojiri, 1979a.

In three species the length to width ratio of the caudal ramus and the body length approach those of the new species. These may be separated from *P. dapsilis* as follows. In *P. accinctus* Humes, 1980, the ratio of the caudal ramus is 2.23:1, the free segment of leg 5 in the female is $42 \times 13 \mu\text{m}$, and the first two segments of the second antenna in the male bear inner spines. In *P. ellisellae* Humes, 1974, the ratio is 2.23:1, the free segment of leg 5 in the female is $80 \times 39 \mu\text{m}$, ratio 2.05:1, with a large prominent proximal inner lobe. In *P. litophyticus* Humes and Dojiri, 1979a, the ratio is 2.67:1, the free segment of leg 5 in the female is $111 \times 26 \mu\text{m}$, ratio 4.27:1, the second antenna of the female has a slender terminal claw $53 \mu\text{m}$, and the female genital double-somite is $127 \times 111 \mu\text{m}$, slightly expanded in the anterior half.

Recognition characters for *P. dapsilis* include (1) its small size, (2) the length to width ratio of the caudal ramus, (3) the shape of the genital double-somite in the female, and (4) the second antenna having a slender claw and not showing sexual dimorphism.

Siphonostomatoidea Thorell, 1859

Asterocheridae Giesbrecht, 1899

Orecturus Humes, 1992

Orecturus finitimus new species

Figures 6a–i, 7a–j, 8a–f

Type Material.—106 ♀, 301 ♂ from *Acanthogorgia* sp., in 17 m, southwestern shore of Goenoeng Api, Banda Islands, Moluccas, $04^{\circ}31'45''\text{S}$, $129^{\circ}51'55''\text{E}$, 30 April 1975. Holotype ♀ USNM (256979), allotype (USNM 256980), and 338 paratypes (88 ♀, 250 ♂) (USNM 256981) deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Remaining specimens in the author's collection.

Other Specimens.—6 ♀, 5 ♂ from *Acanthogorgia* sp., in 25 m, southern shore of Goenoeng Api, Banda Islands, $04^{\circ}32'05''\text{S}$, $129^{\circ}52'30''\text{E}$, 26 April 1975; 1 ♀ from *Villogorgia intricata*, in 30 m, Bohol Island, Philippines, $10^{\circ}17.9'\text{N}$, $124^{\circ}10.9'\text{E}$, 21 August 1975, Thomas Forhan collector.

Female.—Body (Fig. 6a) with broad prosome. Length 0.98 mm (0.94–1.02 mm) and greatest width 0.84 mm (0.47–0.51 mm), based on 20 specimens. Greatest dorsoventral thickness 0.33 mm. Somite bearing leg 3 with pointed epimera. Somite bearing leg 4 small with rounded epimera. Ratio of length to width of prosome 1.55:1. Ratio of length of prosome to that of urosome 2.67:1.

Somite bearing leg 5 (Fig. 6b) $55 \times 170 \mu\text{m}$, with small scalelike spines laterally. Genital double-somite wider than long, $96 \mu\text{m}$ along midline, $112 \mu\text{m}$ including posterior spiniform processes, $140 \mu\text{m}$ wide at level of genital openings, $130 \mu\text{m}$ wide posteriorly. Ratio of greatest length to greatest width 1.25:1. Genital areas (Fig. 6c) situated dorsolaterally just anterior to middle of somite, bearing 2 small unequal setae $14 \mu\text{m}$ and $4 \mu\text{m}$. Two postgenital somites from anterior to posterior $36 \times 91 \mu\text{m}$ and $107 \times 83 \mu\text{m}$, both having scalelike spines laterally and extending over both dorsal and ventral surfaces (all spines not shown in figure).

Caudal ramus (Fig. 6d) $26 \times 42 \mu\text{m}$, wider than long, ratio 0.62:1. Dorsal seta approximately $30 \mu\text{m}$ and smooth. Outer lateral seta $65 \mu\text{m}$, outermost terminal seta $117 \mu\text{m}$, innermost terminal seta $208 \mu\text{m}$, and 2 long median terminal setae

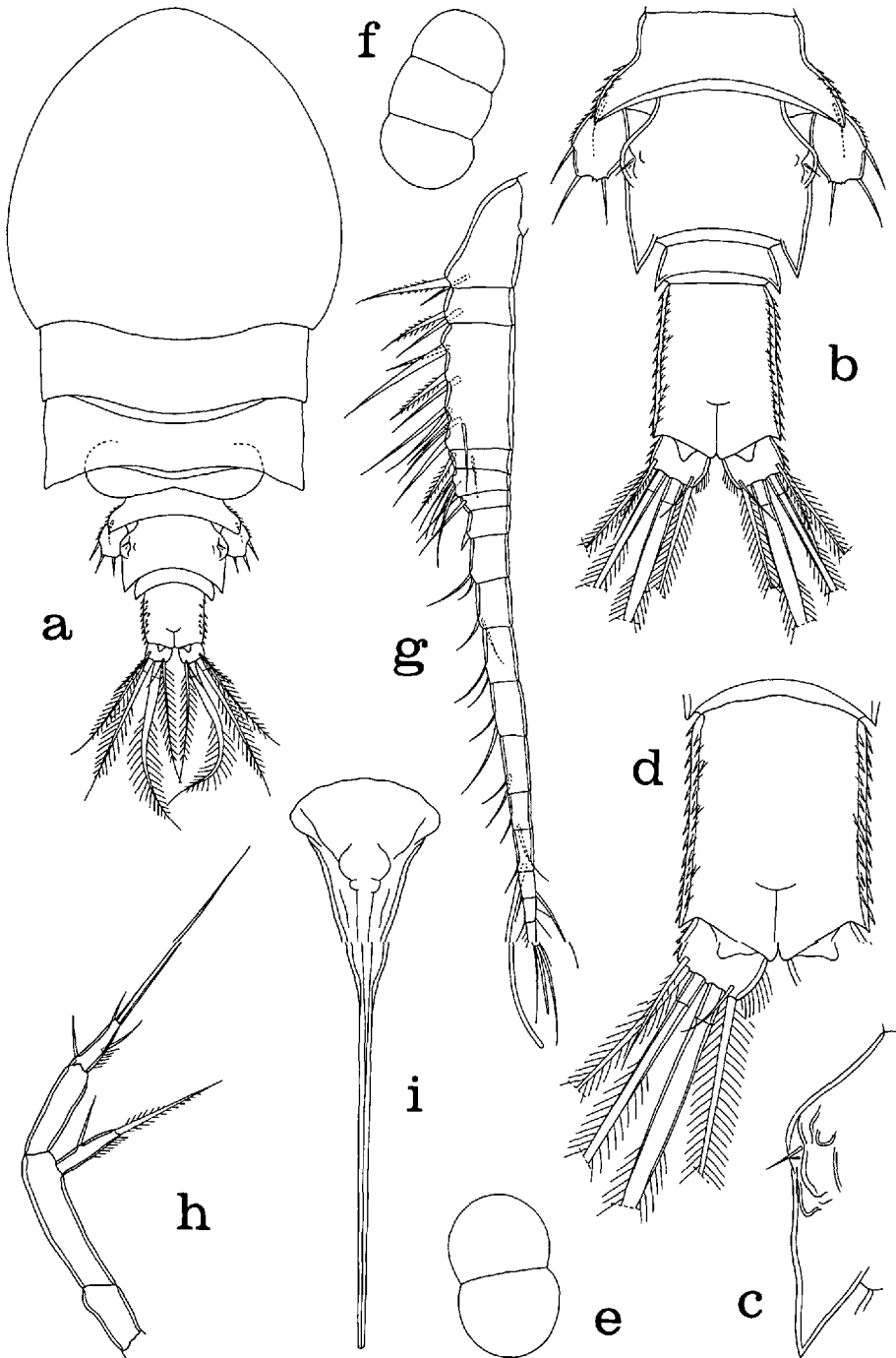


Figure 6. *Orecturus finitimus* n. sp., female. a, dorsal (scale A); b, urosome, dorsal (E); c, genital area, dorsal (D); d, anal somite and caudal ramus, dorsal (C); e, egg sac, ventral (A); f, egg sac, ventral (A); g, first antenna, posterior (C); h, second antenna, posterior (C); i, siphon, ventral (E).

310 μm (outer) and 385 μm (inner), all with lateral setules. Outer side of ramus with scalelike spines, inner side with row of setules.

Dorsal surface of body without visible sensilla. Numerous scalelike small spines on dorsal and ventral surfaces of urosome.

Egg sac $235 \times 148 \mu\text{m}$, containing 2 eggs (Fig. 6e), or $290 \times 143 \mu\text{m}$, containing 3 eggs (Fig. 6f).

Rostrum weakly developed. First antenna (Fig. 6g) 380 μm long, 17-segmented. Lengths of its segments: 31 (57 μm along anterior margin), 19, 55, 13, 8, 8, 14, 18, 21, 23, 26, 24, 26, 26, 13, 13, and 14 μm , respectively. Formula for armature: 2, 2, 10, 2, 5, 1, 1, 2, 2, 2, 2, 2, 2 + 1 aesthete, 2, 3, and 5 + 1 aesthete. Enlarged seta on third segment 68 μm long. Certain setae on segments 1–4 with lateral setules.

Second antenna (Fig. 6h) with short coxa (31 μm long), elongate basis (62 μm long). Exopod elongate, $30 \times 8 \mu\text{m}$, with smooth seta midway on inner margin, terminal barbed seta 53 μm , and setules along outer side. Endopod with first segment 42 μm long, second segment 29 μm long, bearing terminally long seta 105 μm and adjacent short seta, 1 seta and row of setules on outer side, and 1 proximal seta on inner side.

Siphon (Fig. 6i) slender, approximately 412 μm long, reaching in some specimens to somite bearing leg 5, in others to anterior part of genital somite.

Mandible (Fig. 7a) with 1-segmented palp bearing long seta with lateral setules; masticatory part of mandible slender stylet. First maxilla (Fig. 7b) with outer lobe bearing 3 setae, one of them with lateral setules, inner lobe with 5 setae, 3 long and smooth, 1 much shorter than others and directed inwardly, and 1 stout with lateral setules distally; inner margin with few setules. Second maxilla (Fig. 7c) with unarmed basal segment 109 μm long, recurved claw 180 μm long with very slight constriction midway at location of small seta and few minute setules. Maxilliped (Fig. 7d) long and slender, armature 0,1,0,1,1,1 + claw 90 μm long.

Ventral region between maxillipeds and first pair of legs not protuberant.

Legs 1–4 (Fig. 7e, g–i) with 3-segmented rami. Formula for armature as follows:

| | | | | | | | | |
|----------------|------|-----|-------|-----|------------|--------------|--------------|--------------------|
| P ₁ | coxa | 0-1 | basis | 1-I | exp enp | I-1; 0-1; | I-1; 0-2; | II,I,2,3 1,2,3 |
| P ₂ | coxa | 0-1 | basis | 1-0 | exp enp | I-1; 0-1; | I-1; 0-2; | II,II,4 1,1,I,3 |
| P ₃ | coxa | 0-1 | basis | 1-0 | exp enp | I-1; 0-1; | I-1; 0-2; | III,I,3 1,I,3 |
| P ₄ | coxa | 0-1 | basis | 1-0 | exp enp | I-1; 0-1; | I-1; 0-2; | III,I,3 1,I,2 |

Basis of leg 1 with inner spine (Fig. 7f) 36 μm long.

Leg 5 (Fig. 7i) placed ventrally (as in Fig. 6b). Oval free segment $57 \times 39 \mu\text{m}$, ratio 1.46:1, armed with 5 setae from inner to outer 30, 30, 26, 31, and 39 μm , all with minute barbules. Adjacent "dorsal" seta, here located almost ventrally, 30 μm . Outer margin of free segment with few scalelike spines and distal margin with 3 minute spiniform processes.

Leg 6 represented by 2 setae on genital area (Fig. 6c).

Color of living specimens opaque gray, eye red.

Male. — (Fig. 8a) with prosome more slender than in female. Length 0.70 mm (0.65–0.74 mm) and greatest width 0.30 mm (0.29–0.32 mm), based on 10 specimens.

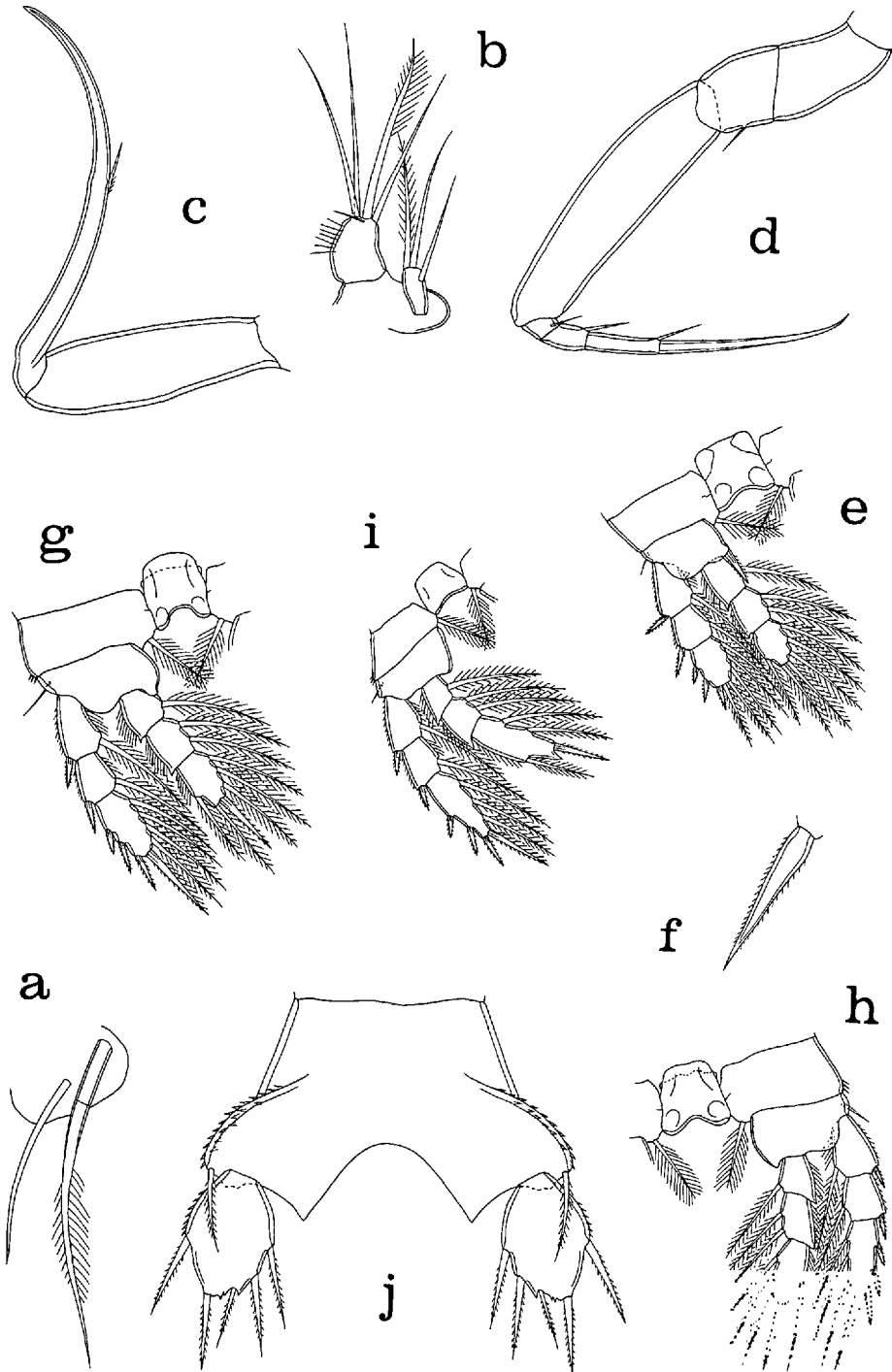


Figure 7. *Orecturus finitimus* n. sp., female. a, mandible, ventral (scale C); b, first maxilla, anterior (C); c, second maxilla, anterior (C); d, maxilliped, anterior (C); e, leg 1 and intercoxal plate, anterior (B); f, inner spine on basis of leg 1, anterior (F); g, leg 2 and intercoxal plate, anterior (B); h, leg 3 and intercoxal plate, anterior (B); i, leg 4 and intercoxal plate, anterior (B); j, fifth pair of legs, ventral (C).

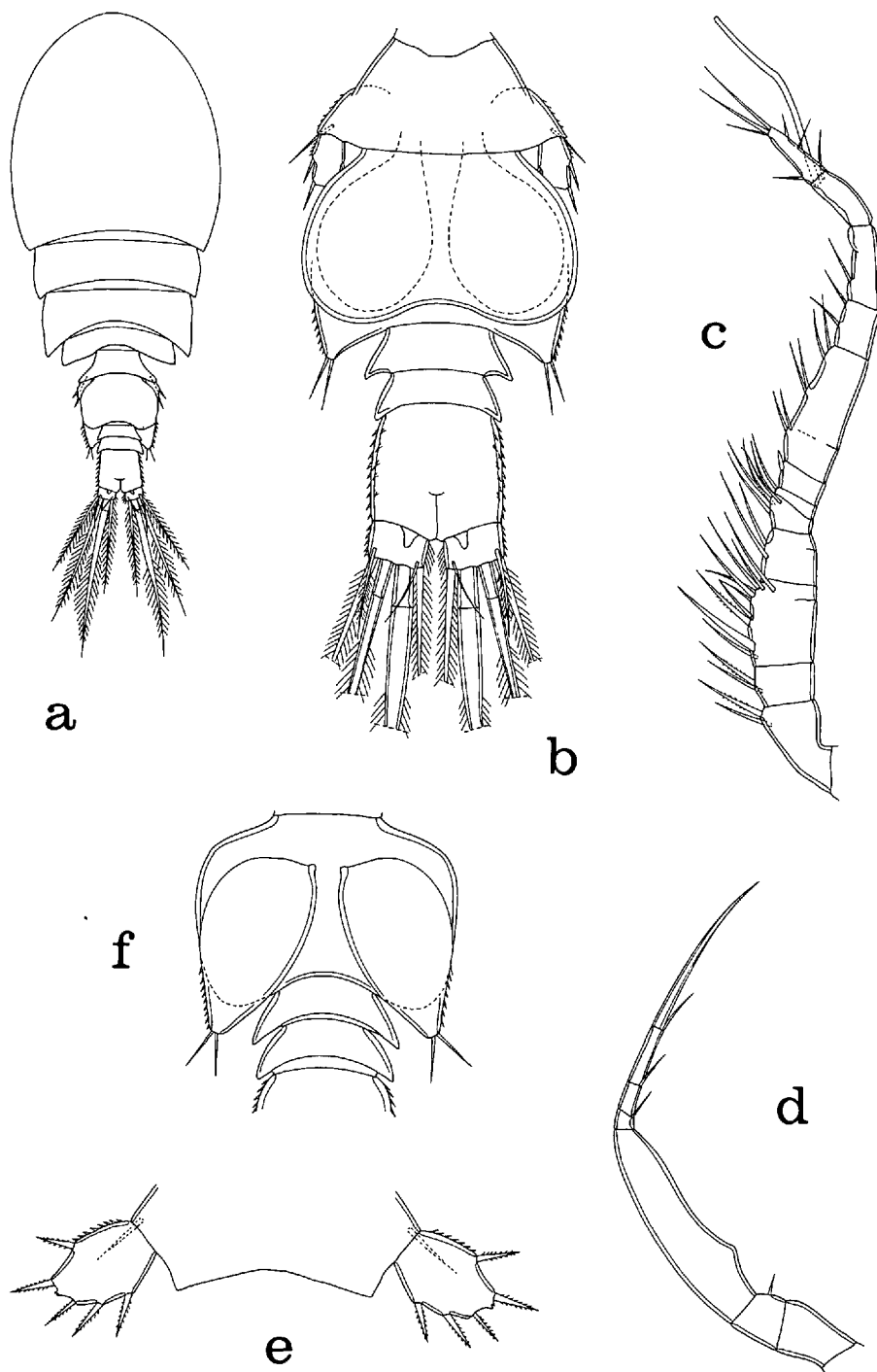


Figure 8. *Orecturus finitimus* n. sp., male. a, dorsal (scale A); b, urosome, dorsal (C); c, first antenna, dorsal (C); d, maxilliped, posterior (C); e, fifth pair of legs, dorsal (D); f, genital and first two postgenital somites, ventral (C).

Epimera of segment bearing leg 4 pointed rather than rounded as in female. Ratio of length to width of prosome 1.61:1. Ratio of length of prosome to that of urosome 2.20:1.

Segment bearing leg 5 (Fig. 8b) $50 \times 114 \mu\text{m}$. Genital somite broader than wide, $80 \mu\text{m}$ along midline, $96 \mu\text{m}$ including leg 6, and $130 \mu\text{m}$ wide. Three postgenital somites from anterior to posterior 26×70 , 18×61 , and $52 \times 70 \mu\text{m}$. Greatest length of anal somite in midregion $62 \mu\text{m}$.

Caudal ramus (Fig. 8b) $18.5 \times 32 \mu\text{m}$, similar to that of female.

Body surface with small, hyaline, scalelike spines on urosome as in female.

Rostrum as in female. First antenna (Fig. 8c) $328 \mu\text{m}$ long, 12-segmented (but segment 8 with indistinct line of division on ventral side). Lengths of its segments: 24 ($44 \mu\text{m}$ along anterior margin), 18, 36, 23, 5, 7, 13, 60, 24, 39, 30, and $29 \mu\text{m}$, respectively. Formula for armature: 2, 2, 10, 2, 5, 1, 1, 6, 2, 1, 1 + 1 aesthete, and 6. Second antenna, siphon, mandible, first maxilla, second maxilla, and ventral area between maxillipeds and first pair of legs as in female. Maxilliped (Fig. 8d) with slight sexual dimorphism, having low prominence on inner side of second segment.

Legs 1–4 like those of female.

Leg 5 (Fig. 8e) with free segment $31 \times 22 \mu\text{m}$, ratio 1.41:1.

Leg 6 (Fig. 8f) posteroventral flap bearing 2 setae approximately $20 \mu\text{m}$ long.

Color of living specimens as in female.

Etymology.—The name *finitimus*, Latin meaning neighboring or near, refers to the close relationship of this species to *O. grandisetiger*.

Remarks.—*Orecturus finitimus* differs in several ways from its congener, *Orecturus grandisetiger* Humes, 1992, a species found on *Antipathes* in Madagascar (Humes, 1992c). In the female, the free segment of leg 5 in *A. finitimus* is $57 \times 39 \mu\text{m}$ (ratio 1.46:1), while in *A. grandisetiger* this segment is $104 \times 59 \mu\text{m}$ (ratio 1.76:1); the anal somite of *A. finitimus* is $107 \times 83 \mu\text{m}$, longer than wide, while in *A. grandisetiger* this somite is $117 \times 130 \mu\text{m}$, wider than long; the siphon in *A. finitimus* reaches to the somite bearing leg 5 and in some cases to the anterior part of the genital somite, while in *A. grandisetiger* the siphon reaches only to the posterior edge of the intercoxal plate of leg 3. In the male, the basis of the maxilliped in *A. finitimus* has a strong inner protuberance, while in *A. grandisetiger* this protuberance is weak.

Orecturus forticulus new species

Figures 9a–c, 10a–i, 11a–d

Type Material.—8 ♀ from *Melitodes ochracea* (Linnaeus), in 3 m, southwestern shore of Goenoeng Api, Banda Islands, Moluccas, $04^{\circ}31'45''\text{S}$, $129^{\circ}51'55''\text{E}$, 4 May 1975. Holotype (USNM 256982) and 4 paratypes (USNM 256983) deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Remaining paratypes (dissected) in the collection of the author.

Female.—Body (Fig. 9a) with prosome broad, slightly truncated anteriorly, and thickened dorsoventrally. Length 1.17 mm (1.09–1.26 mm) and 0.72 mm (0.66–0.78 mm), based on 2 specimens. Greatest dorsoventral thickness 0.50 mm. Epimera of somite bearing first pair of legs rounded, those of somite bearing second pair of legs pointed, and those of somite bearing third pair of legs still more pointed and flaring laterally in dorsal view. Somite bearing fourth pair of legs small with rounded epimera. Ratio of length to width of prosome 1.08:1. Ratio of length of prosome to that of urosome 2.14:1.

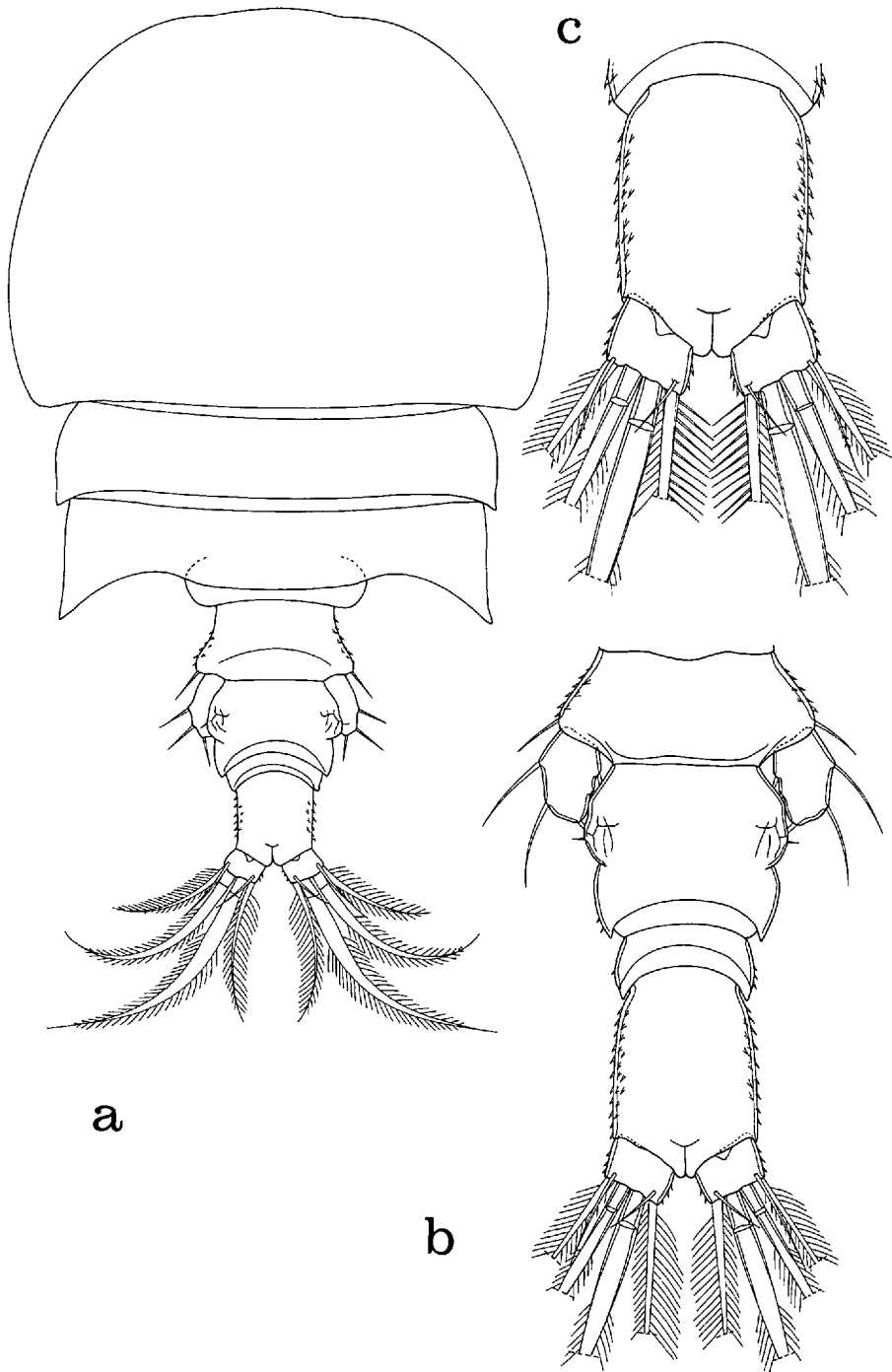


Figure 9. *Orecturus forticulus* n. sp., female. a, dorsal (scale A); b, urosome, dorsal (E); c, anal somite and caudal rami, dorsal (C).

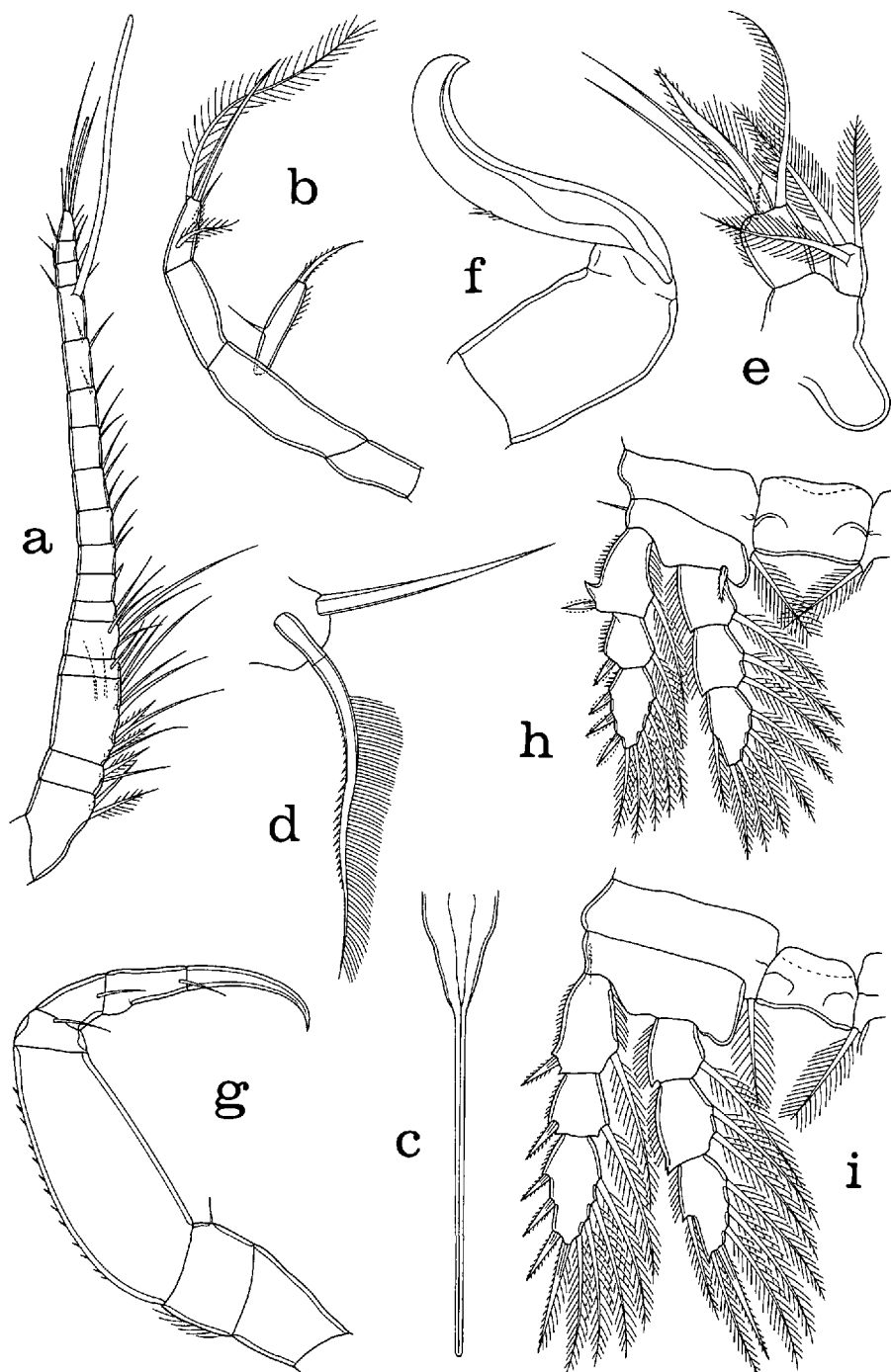


Figure 10. *Orecturus forticulus* n. sp., female. a, first antenna, anterior (scale C); b, second antenna, posterior (C); c, siphon, ventral (B); d, mandible, ventral (C); e, first maxilla, posterior (C); f, second maxilla, anterior (C); g, maxilliped, anterior (C); h, leg 1 and intercoxal plate, anterior (E); i, leg 2 and intercoxal plate, anterior (E).

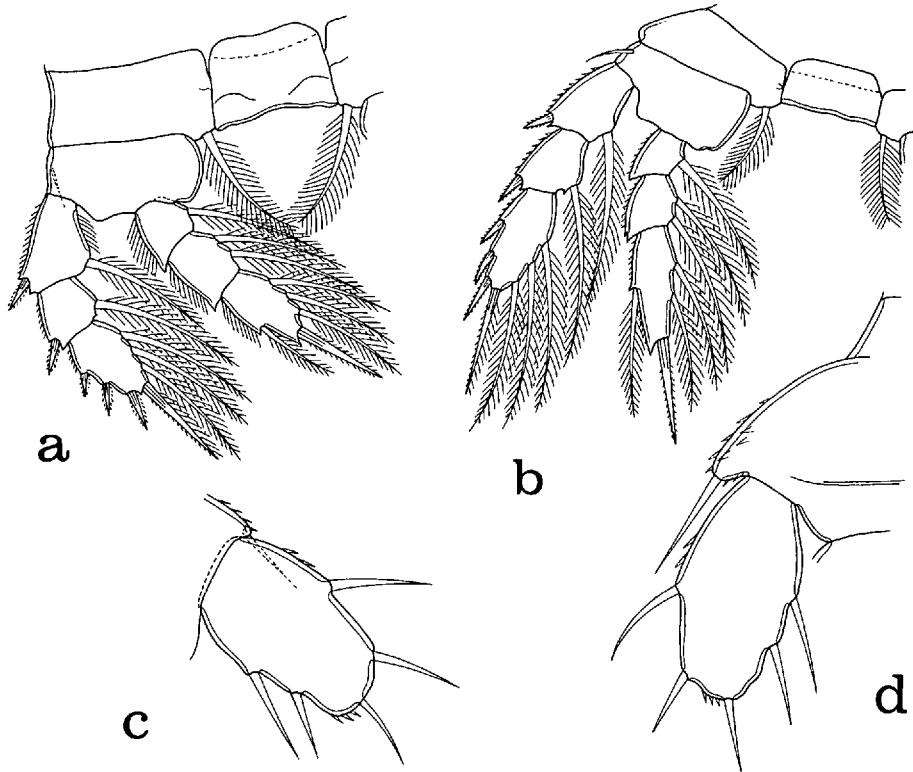


Figure 11. *Orecturus forticulus* n. sp., female. a, leg 3 and intercoxal plate, anterior (scale E); b, leg 4 and intercoxal plate, anterior (E); c, leg 5, dorsal (D); d, leg 5, ventral (D).

Somite bearing leg 5 (Fig. 9b) $70 \times 180 \mu\text{m}$. Genital segment wider than long, $120 \mu\text{m}$ long, $156 \mu\text{m}$ wide anterior to lateral indentation, $138 \mu\text{m}$ wide posterior to indentation. Genital areas located dorsolaterally just in front of indentation, each area bearing 2 minute setae. Two postgenital somites from anterior to posterior 39×100 and $107 \times 99 \mu\text{m}$.

Caudal ramus (Fig. 9c) wider than greatest length, $34 \mu\text{m}$ along outer side, $26 \mu\text{m}$ along inner side, and $45 \mu\text{m}$ wide. Ratio of outer length to width 0.75:1. Outer lateral seta $77 \mu\text{m}$, displaced laterally. Dorsal seta $39 \mu\text{m}$. Outermost terminal seta $209 \mu\text{m}$, innermost terminal seta $242 \mu\text{m}$, and 2 long median terminal setae $330 \mu\text{m}$ (outer) and $363 \mu\text{m}$ (inner). All setae except smooth dorsal seta with lateral setules, those on inner side of innermost terminal seta unusually long.

Urosomal somites with small scalelike surficial spines as in Fig. 9b.

Rostral area weak but slightly protruding anteriorly (Fig. 9a). First antenna (Fig. 10a) 17-segmented. Formula for armature as in *Orecturus finitimus*. Lengths of segments: 20 ($47 \mu\text{m}$ along anterior margin), 17, 44, 11, 16, 14, 14, 14, 17, 21, 21, 20, 22, 24, 11, 11, and $13 \mu\text{m}$, respectively. All setae smooth except for few with lateral setules on first 3 segments. Aesthete on segment 14 $142 \mu\text{m}$ long.

Second antenna (Fig. 10b) with coxa $44 \mu\text{m}$ and basis $65 \mu\text{m}$, both measured along inner side. Exopod 1-segmented, $49 \times 8 \mu\text{m}$, bearing lateral seta and barbed terminal seta $33 \mu\text{m}$, and ornamented with few outer lateral setules. Endopod with unarmed first segment $52 \mu\text{m}$ long; second segment $33 \mu\text{m}$ long, bearing proximal seta with lateral setules, subterminal seta, and 2 terminal elements, one

spine 75 μm , other long conspicuously feathered seta 135 μm , this segment ornamented with few small outer setules.

Siphon (Fig. 10c) elongate, 45 μm long, reaching intercoxal plate of leg 1.

Mandible (Fig. 10d) with 1-segmented palp bearing long seta with unusually long setules along 1 side, other side with short spinules. First maxilla (Fig. 10e) with 2 lobes bearing 3 and 5 setae as in *O. finitimus*. Second maxilla (Fig. 10f) with unusually stout claw, 165 μm long, with minute seta and few small setules midway. Maxilliped (Fig. 10g) in general like that of *O. finitimus* but more slender, claw shorter (65 μm), and with small spines along outer margin of elongated basis.

Ventral region between maxillipeds and first pair of legs not protuberant.

Legs 1–4 (Figs. 10h, i, 11a, b) segmented and armed as in congeners. Leg 1 with inner spine on basis short, 22 μm , and first segment of exopod with outer margin near insertion of spine projecting as thornlike process (Fig. 10h).

Leg 5 (Fig. 11c, d) with free segment in dorsal view $73 \times 40 \mu\text{m}$, its 5 setae from outer to inner 29, 28, 26, 23, and 32 μm . Three small spinules between second and third inner setae. Free segment in ventral view as in Fig. 11d.

Leg 6 represented by 2 setae on genital area (Fig. 9b).

Color of living specimens reddish brown (perhaps derived from red color of host gorgonacean), eye red.

Male. — Unknown.

Etymology. — The name of the species is the diminutive form of the Latin word *fortis* meaning strong, and alludes to the rather massive claw on the second maxilla.

Remarks. — *Orecturus forticulus* may be distinguished by its anteriorly truncated prosome, the long plumose terminal seta on the second antenna, the stout claw on the second maxilla, and the thornlike process on the first segment of the exopod of leg 1.

Orecturus grandisetiger Humes, 1992

Material Studied. — 24 ♀, 14 ♂ from *Acanthogorgia* sp., in 17 m, southwestern shore of Goenoeng Api, Banda Islands, Moluccas, 04°31'45"S, 129°51'55"E, 30 April 1975; 17 ♀, 12 ♂ from *Acanthogorgia* sp., in 25 m, southern shore of Goenoeng Api, 04°32'05"S, 129°52'30"E, 26 April 1975.

Remarks. — This species is known only from *Acanthogorgia* sp. at Goenoeng Api.

Asteropontius latus Humes, 1992

Material Studied. — 7 ♀ from *Villogorgia intricata*, in 30 m, Bohol Island, Philippines, 10°17.9'N, 124°10.9'E, 21 August 1975, Thomas Forhan collector.

Remarks. — This species has been known previously only from the antipatharian *Antipathes* sp. at Bohol Island (Humes, 1992).

Gorgonaceans reported in this paper with their associated copepods: *Acalycigorgia* sp. with *Acanthomolgus astrictus*; *Acanthogorgia* sp. with *Acanthomolgus astrictus*, *Orecturus finitimus* and *Orecturus grandisetiger*; *Echinogorgia* sp. with *Acanthomolgus combinatus*; *Melitodes ochracea* with *Orecturus forticulus*; *Muricella* sp. with *Acanthomolgus astrictus*; *Rumphella antipathes* with *Acanthomolgus astrictus*, *Doridicola cinctus* and *Doridicola rumphellae*; *Suberogorgia reticulata* with *Paramolgus dapsilis*; *Villogorgia intricata* with *Acanthomolgus astrictus*, *Forhania philippinensis*, *Orecturus finitimus* and *Thamnomolgus nodulus*.

Copepods reported in this paper and their gorgonacean hosts: *Acanthomolgus astrictus* on *Acalycigorgia* sp., *Acanthogorgia* sp., *Muricella* sp., *Rumphella antipathes* and *Villogorgia intricata*; *Acanthomolgus combinatus* on *Echinogorgia* sp.; *Doridicola cinctus* on *Rumphella antipathes*; *Doridicola rumphellae* on *Rumphella antipathes*; *Forhania philippinensis* on *Villogorgia intricata*; *Orecturus finitimus* on *Acanthogorgia* sp. and *Villogorgia intricata*; *Orecturus forticulus* on *Melitodes ochracea*; *Or-*

ecturus grandisetiger on *Acanthogorgia* sp. *Paramolgus dapsilis* on *Suberogorgia reticulata*; *Thamnomolgus nodulus* on *Villogorgia intricata*.

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